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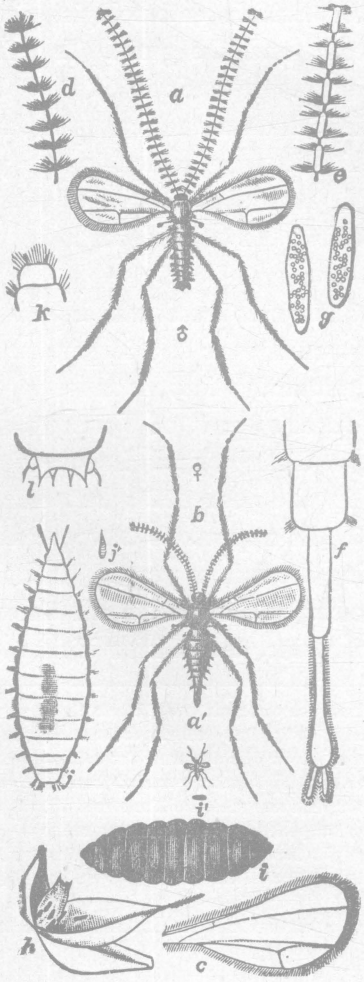
ARTICLE VIII.—THE WHEAT MIDGE, *Diplosis tritici*, KIRBY.



Wheat Midge—*Diplosis tritici*. (*a*) Male; (*b*) female; (*a'*) natural size; (*c*) wing, greatly enlarged; (*d*) antennal joints of male; (*e*) ditto, of female; (*f*) ovipositor; (*g*) eggs, greatly magnified: (*h*) flower of wheat, showing larvæ on kernel; (*i*) larva in repose; (*j*) ditto, crawling; (*j'*) natural size; (*k*) enlarged view of anterior end when moving; (*l*) posterior end, with teeth protruding to aid in motion. (After Fitch.)

This depredator is known also as the Red Weevil, on account of the color of the maggots or young, and under this name will be best recognized by farmers, especially those who witnessed its ravages in 1854. Others will readily understand the nature of the pest by its occurrence in the heads of the wheat, under the chaff, giving these, when very abundant, a reddish appearance somewhat resembling rust.

This insect belongs to the order *Diptera*, or two-winged flies, and to the family *Cecidomyidæ*. In the light of exact knowledge, the original discovery of the species dates back to the year 1795. In the summer of that year, and in the neighborhood of Ipswich, Suffolk, England, Rev. Wm. Kirby, the noted British entomologist, found citron-colored larvæ between the corolla and the grain. Indefinite references to what may have been this pest go back to 1741.* The following year, 1796, a farmer of Hertfordshire, detected the larvæ attacking the ears of wheat. The adult flies were reared in the year 1797 by Mr. Markwick, of Catsfield, near Battle, and afterwards described by Mr. Kirby as *Tipula tritici;* larva and parasites also being described.

There seems little reason to doubt that this insect was introduced into Canada, first, from whence it has spread over the larger portion of the eastern United States. The wheat midge first made its appearance in the United States, in the northwestern part of Vermont, and, according to Mr. Solomon W. Jewett, a distinguished farmer of the state at that time, was first observed in the year 1820, but did not become abundant until 1828 and 1829. It appears to have occurred in the region of Quebec, Canada, during the former year.

In 1835–36, the pest was exceedingly destructive all through Vermont,† across New Hampshire to Maine, and in New York south

* In Ellis' Modern Husbandman for 1745, the attacks of the vast numbers of black flies (the ichneumon parasites) are noticed in the following quaint terms: "after this we had a melancholy sight, for as soon as the wheat had done blooming, vast numbers of black flies attacked the wheat ears, and blowed a little yellow maggot which ate up some of the kernels, in other parts of them, and which caused multitudes of ears to miss of their fulness, acting in some measure like a sort of locust, till rain fell and washed them off; and though this evil has happened in other summers to the wheat in some degree, and not done much harm, yet if the good providence of God had not hindered it, they might have ruined all the crops of wheat in the nation." Hind's Essay on the Insects and Diseases Injurious to Wheat Crops, p. 76.

† According to other authorities it was seriously destructive in Vermont from 1830 to 1845.—F. M. W.

to Rensselaer county and west through Saratoga county, doing so much damage that in many localities wheat growing was abandoned. Continuing its course to the westward and southward, it was more or less injurious up to 1854, when its devastation was greater than ever before. In New York alone Dr. Fitch estimated the loss to amount to over $15,000,000. The pest had by this time pushed its way westward to eastern Indiana, and the damage both here and throughout Ohio was nearly as severe as in New York. In 1856, though not exceedingly abundant in the United States, except in western central New York, in the Canadas the damage was estimated at $2,500,000. In 1857 and 1858 in central New York, wheat growing was so much interferred with that the price of wheat land declined from $70.00 to $40.00 per acre. Comparatively little injury was done in 1859, either in Canada or the United States, and in 1860 the pest seemingly disappeared; although Dr. Fitch, whose account we are following, observed adults in abundance yet he saw but few larvæ. In 1861, however, they appeared again and worked considerably injury. But, as this was the year of the outbreak of the grain aphis *Siphonophora avenæ*, it would be impossible to give exact data of the damage of this pest, as the work of the two was often, doubtless, confused by farmers. From 1861, for a period of twenty-eight years, no serious, widespread outbreak occurred. Reports of local injuries, however, were frequently recorded. In 1862 it appeared in Franklin county, Maryland,[1] in some parts of Ohio, and in Pennsylvania and Ohio in 1867,[2] while it was quite destructive in Canada in 1868.[3] It appeared in Farwell county, Virginia, Bracken and Anderson counties, Kentucky, in 1874,[4] while Prof. Riley reported it as occurring in Indiana in 1876,[5] Canada appearing to be visited again in 1879.[6] In 1884 the pest appeared over a wide section of country. Mr. W. L. Devereaux[7] reported the fields of Wayne and Seneca counties, of New York,

1 Pract. Ent., vol. II, p. 94.
2 Loc. cit., p. 99.
3 Rep. Ent. Soc., Ontario, 1871, p. 47.
4 Report Comm. Agr., 1874, p. 129.
5 Ann. Rep. Geog. and Geog. Surv. Terr., 1875, p. 709.
6 Can. Ent., vol. XI, p. 187.
7 Rural New Yorker, Aug. 16, 1884.

threatened with serious damage, and they were observed quite abundantly by us in Indiana during the same year.[3]

Mr. James Fletcher, formerly entomologist to the Canadian Department of Agriculture, and later entomologist of the Central Experiment Farm, in his reports for the years 1885, 1887 and 1888, informs us that the pest was generally prevalent in the Dominion in 1884 and to a greater or less degree during the five years following, Nova Scotia being especially affected. In 1875 Dr. A. S. Packard gave the distribution of the wheat midge as extending over all of that portion of the United States, north of Latitude 35° and east of Longitude 92°, except eastern North Carolina, western Tennessee, eastern Minnesota, eastern Iowa, except near the Mississippi river, and Wisconsin. Besides this, it extends southward nearly across the state of Arkansas, and in northeastern Alabama and northern Georgia.* The next general appearance will doubtless indicate a further advance westward. Dr. Fitch states that the adults first appear in considerable numbers in eastern New York, about or a little before the middle of June, simultaneously with the first appearance of the fire flies, and at the season when the white blossoms on the locust trees (*Robinia pseudacacia*) are fading and dropping to the ground.

According to Dr. Fitch the eggs are placed, as a rule, in a small cavity at the summit of, and formed by a groove in the outmost chaff covering the incipient kernel. Mr. Kirby stated that the eggs were placed in position by a long hair-like ovipositor, but Dr. Fitch found that this appendage did not really exist, and that the ovipositor consisted of two retracted segments of the abdomen in many respects like those of the Hessian fly. The time required for the eggs to hatch after deposition is not definitely known, but Fitch concludes that it is about one week. The same author states that the full grown larvæ can travel only upon moist surfaces, and if this is not offered at the time it reaches maturity the outer skin gradually dries and becomes hardened, the larva itself thereby becoming encased. In this state it remains on the head of the grain until moisture is provided, when it breaks forth

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3 Rep. Comm. Agr, 1884, p. 389. Loc. cit., 1885, p. 318.

* Ninth Annual Rep. U. S. Geog. & Geol. Surv. Terr., map showing distribution of Hessian fly and Wheat midge.

from its envelope and makes its way to the ground. Larvæ, immature at the time of the ripening of the grain, also dry up and apparently die, but Dr. Fitch found that on placing these in the folds of a damp cloth, they at once regained their vitality; it did not appear, however, that they cast the dried skin as in case of mature larvæ.

After entering the ground, the larvæ are stated by foreign authors to construct a cocoon, within which they pass the winter. Indeed, these cocoons are to be found without trouble in our fields after an outbreak of the midge. Fitch, however, found naked larvæ in the earth when the snows had melted away in March, and attempts to account for this occurrence, on the ground that they were in the vicinity of a barn, where the wheat had been thrashed during winter, and that the larvæ having been carried to the barn in the heads of the wheat were also carried to the fields on the chaff so late in winter that they could not burrow into the earth, on account of the frozen nature of the surface. This is the only plausible excuse that Dr. Fitch could think of and this is to some extent contradicted by the fact that larvæ, also naked, were found abundantly in a field in Lancaster county, Pennsylvania, after a heavy rain on the 15th of May. These last were evidently swept from various parts of the field to a low place, and there left by the flood, Mr. Walsh explaining that the lack of cocoons was due to the latter having been washed away by the action of the water.* From Fitch's observations, it will be seen that naked larvæ can and do survive the winter in the fields, and, besides, the young larvæ which he says descend from the heads of the grain, and are very tenacious of life, remain to be accounted for. Dr. Fitch found that after the ripening of the grain the larvæ continued to descend to the earth with every rain up to October 23rd.

We have reared considerable numbers of adults from volunteer wheat, taken from a field which had been infested with the midge. These plants were removed to the breeding cage on September 1st, and in this cage adult midges appeared continually up to the 3rd of November,† the cage being kept out of doors during the entire time.**

* Prac. Ent., vol. II, p. 99.

† Rep. Comm. Agr , 1885, p. 318.

** *Note.* Mr. Fletcher has observed adults abroad in Canada during August and early September. Experimental Farm Reports, 1888, p. 49.

Did these adults that appeared thus continuously originate from young, undeveloped larvæ, which had hatched from eggs deposited on the heads of grain, or did they make their way to the ground in their half developed state? If so, how did they find sustinence, by which they were enabled to go on and finish their larval period?

From other volunteer wheat plants, but from the same field as those placed in breeding cage, we took larvæ bearing every indication of being those of *Diplosis tritici*, they being found under the sheaths of the young growing plants. Besides these, other larvæ not distinguishable from the above were found under the sheaths of young wheat plants, and adults swept therefrom, in a field sown among growing corn and fully half a mile from any other grain fields. In this last field the wheat midge occurred the following June in small numbers. It seems, therefore, that though all larvæ observed by us might not have been those of *D. tritici*, yet no other *Cecidomyia* were reared from them and they did not occur except in conjunction with adults which were unmistakably that species. If the larvæ were those of the wheat midge, then the former appear to have the power of subsisting upon the young wheat plants themselves, and, hence, the young larvæ which have so far been lost sight of when they left the heads may be able to continue their development on young volunteer wheat, unless it should be found that they subsist on rust spores as well as the grain. If this should prove true, it would also strongly indicate that at least some of the early developing females deposited their eggs on the young plants and the larvæ hatching therefrom developed from them. We also reared adults from the heads of rye during the month of July, 1884.

While Hymenopterous parasites were observed almost simultaneously with the midge in Europe, up to the present time they have been very rarely observed in America. Of other natural enemies Dr. Fitch* states that the common Yellow Bird, *Carduelis Americana*, feeds upon the larvæ. In June, 1884, we observed the following insects also preying upon the larvæ: *Megilla maculata, Prodabrus tomentosus, Telephorus Carolinus* and *T. rectus*.†

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*Trans N Y St Ag Soc, 1860, p. 821.

†Rep. Comm. Agr, 1884, p. 389.

The only thoroughly practical preventive, and also the one promising the best results, is deep plowing of wheat stubble in the fall, thereby covering the midges so deep in the earth that they are unable to reach the surface in the spring. This should be done as soon as possible after harvest. Burning the stubble before plowing will also destroy any which have remained therein, and a rotation of crop will add greatly to the efficiency of deep plowing. Sowing the wheat in the fall, at a distance from stubble fields, obliges the adult midges to travel from one field to another, during which change more or less are likely to be destroyed.

Early sown wheat may escape with less injury, though this is not altogether clear, and besides, early sown grain is more liable to attack of Hessian fly. Therefore, all things considered, the hope of prevention lies in deep fall plowing, burning stubble and rotation of crop.

THE WHEAT MIDGE IN OHIO.

Under this head we have brought together, as far as the literature at hand will admit, all of the earlier references to the appearance, spread and depredations of this species within the state. A number of the earlier agricultural publications are, even now, well-nigh inaccessible, and others are yearly becoming more rare; therefore, if the bringing this data together resulted only in perpetuating and rendering it accessible to the farmer and student, it would seem that the end would justify the effort.

These transcripts have been taken, almost without exception, from the Annual Reports of the State Board of Agriculture, and are the reports of county societies to the State Board of Agriculture, for the years indicated. As these State Reports begin with the year 1847, of course all data from this source relates to more recent years, and we have not brought the record down to a later date than 1880, as the recent publications are of easy access.

The earliest record we have of the occurrence of the wheat midge in Ohio, is found in the (Albany, N. Y.) Cultivator for August, 1849, p. 256. The writer thereof, though he seems conversant with the subject, does not give his name, but states that he discovered a few speci-

mens in the interior of the state in 1843. From this date we have no information of the occurrence of the wheat midge until the subject is taken up in the Reports of the State Board of Agriculture, as follows·

1847.

Delaware County.—The weevil or ground-worm destroyed all of the latest heads ot winter wheat, and the whole of the spring wheat. Second Ann. Rep. St Bd Agr., Doc. No. 19, p. 315, 1847.

1849.

Champaign County.—The crop, last season, was destroyed by red rust accompanied by a small worm, which preyed upon the kernel in its milky state. Fourth Ann Rep. St. Bd. Agr., 1850, p. 61.

Erie County.—This year a new enemy has appeared, called the red weevil, which was very destructive to many pieces. Loc. cit, p. 87.

Red weevil, so-called, made its appearance this year and injured the crop, say from 10 to 20 per cent. Loc. cit., p. 89.

Holmes County.—Badly injured by rust and red weevil. Loc cit., p. 118.

Huron County.—The past season, the crop suffered most from wheat midge—no remedies known at present. Loc. cit., p. 122.

Knox County.—The wheat crop of the present year was greatly injured by rust, and to some extent by red weevil or midge. Loc. cit., p. 130.

Lorain County.—Weevil was very injurious in the south part of the county Loc. cit., p. 147.

Morgan County.—New enemies to this crop made their appearance among us last harvest, in the form of insects within the stalks and beneath the chaff, feeding upon the grain; they soon changed to flies. They caused the grain to shrivel by abstracting the juices which should have gone to nourish the grain. Loc. cit., pp. 177-8.

Ottawa County.—Wheat much injured by the rust, and insect in the head. Loc. cit, p. 184.

Richland County.—Damaged by rust and by the wheat-fly or yellow weevil. Loc. cit, p. 191.

Union County.—The rust, and injury by the fly at harvest, having destroyed the grain in the chaff, many farmers have been discouraged and omitted to sow for some years. Loc. cit., p. 208.

1850.

Erie County.—For a year or two the midge or red worm has injured it, this year neither it nor the Hessian fly did perceptible injury. Loc. cit., Fifth Ann. Rep. St. Bd. Agr., p. 159.

Hancock County.—Red weevil and rust are injurious. Loc. cit., p. 197.

Hardin County.—The injury to which wheat is most liable is red rust, red weevil and a small worm which destroys the roots in fall and winter seasons. Loc. cit., p. 198.

Morgan County.—Crop not injured by rust or midge Loc cit., p. 315.

Ottawa County.—In 1849 the weevil injured the crop in the western part of our county materially, but nothing to complain of this season. Loc. cit., p. 329.

Union County.—Crop suffers here from the rust, fly and wheat midge. Loc. cit., p. 383

Wyandot County.—Injured by red weevil, but escaped this year. Loc. cit., p. 247.

1851.

Crawford County.—The wheat crop was considerably injured by a small yellow weevil that committed great depredations on our crop of 1849. Ohio Agr'l. Report 1851, p. 266.

1852.

Allen County.—This season much trouble with red weevil—not common in this country. Ravages have been extensive this season. Ohio Agr'l. Report 1852, p 135.

Ashland County.—The yield this year will not be more than 12 bushels per acre, owing to the ravages of the weevil. Loc. cit., p. 137.

Crawford County.—The past season's yield will not average over 5 bushels per acre, rust and weevil being the cause of injury. Loc. cit., p. 178.

Delaware County.—The wheat crop of our county was this year greatly injured by weevil. Loc. cit, p. 187.

Hardin County.—For the last three or four years our wheat crop has been very materially injured by the red weevil. The past year (it) has been unusually destructive, many fields being entirely destroyed, not being harvested, and nearly all of our wheat has been more or less injured from the above cause. Loc. cit., p. 213.

Lawrence County.—The red weevil is unknown here. Loc. cit., p. 258.

Morrow County.—Rust and red weevil injure our crops most. Loc. cit., p. 310.

Muskingum County.—In the western part of the county the red weevil injured the wheat. This is a new enemy which has never before visited us, although he has been committing his depredations in the north-west part of the state, say about Union County, for some seven or eight years. Loc. cit., p. 313.

Richland County.—The wheat insect or red weevil destroyed very much of our wheat while it was in the milky stage. Loc. cit., p. 334.

Union County.—Crop here suffers most from rust, fly and wheat midge. Loc cit., p 367.

Wood County.—Wheat hurt by weevil, the Mediterranean least affected. Loc. cit, p. 383.

Wyandot County.—The last season's crop, owing to the ravages of the weevil, was not more than half an average one. Loc. cit., p. 388.

1853.

Crawford County.—Crop will not average more than 8 bushels per acre; cause of injury, rust and yellow weevil. Ohio Agr'l. Report 1853, p. 102.

Defiance County.—Fly and weevil are the main enemies. Loc. cit., p. 108.

Hancock County.—Wheat liable to injury from fly and red weevil. Loc. cit., p. 123.

Hardin County.—The wheat crop has been materially injured by the red weevil for three or four years past, in many cases fields entirely destroyed. Not so much injured the past as some of the previous years, which is perhaps mainly to be attributed to early sowing and cultivating the Mediteranean variety. Loc. cit, p. 126.

Knox County.—The crop has been almost an entire failure. No remedy has been discovered for the weevil, the most destructive enemy with which we are acquainted. Loc. cit, pp, 145, 146.

Licling County—Much damage has been done in the last two years by wheat midge or red weevil. Loc. cit., p. 153.

Lorain County.—Red weevil injured late sown wheat. Loc. cit., p. 157.

Lucas County.—Greatest enemy, the fly, next, the red weevil. Loc. cit., p. 160.

Muskingum County.—The wheat was much injured by weevil in the west part of county, more or less was not cut at all, particularly on low ground where it was longer in ripening. Loc. cit, p. 187.

Ottawa County.—Crop this season was considerably injured by red weevil, so-called.

Perry County.—Crop materially injured by the fly and red weevil, on low lands Loc. cit., p. 194.

Richland County.—Until recently, wheat has been the principal article of produce in this county. But the weevil has made depredations the past year on all the late growths, so that it is now greatly superseded by the corn crop. Loc. cit., p. 211.

Scioto County.—A few years since the weevil affected our wheat to a great extent; since that we are not aware of any disease or injury to which it is liable. Loc. cit., p. 218.

Wood County.—Wheat sown early was injured by Hessian fly, and that sown late by the weevil, in June. Loc. cit., p. 245.

1854.

Allen County.—We have been troubled with the weevil for many years. Wheat is our principal crop which, owing to the red weevil, was almost a total failure this year. I would recommend the use of Mediterranean, sowed early. Ohio Agr'l. Report 1854, p. 85.

Hancock County.—Wheat was mostly destroyed by the weevil. Loc. cit., p. 115.

Lorain County.—The past season has been a very disastrous one to our farmers, owing to the weevil which destroyed our wheat crop. Loc. cit., p. 130.

Morrow County.—Wheat crop failed to a large extent, caused, first, by severe weather last winter; second, the wheat midge or red weevil destroyed it after it had bloomed. Loc. cit., p. 139.

Muskingum County.—Wheat was extensively injured by the weevil. The eastern part of the county, which has heretofore been mostly exempt from the effects of this enemy, was severely visited by them this season. The Mediterranean, if sown early, affords the surest protection against his ravages. Loc. cit. p. 140.

Pickaway County.—Wheat affected with weevil, rust and Hessian fly. No prevention better than to sow Mediterranean—early. Loc. cit., p. 142.

Wood County.—Wheat has failed here this year; cause, the weevil.* Loc. cit., p. 165.

1855.

Coshocton County.—The wheat crop was severely damaged by the ravages of the yellow weevil. The fall was so dry that the early-sown wheat did not vegetate until quite late in October, (except on very loamy lands) and the latter part of winter and fore part of spring threw the plants out, so that it was rather late, and all that was late was entirely destroyed by the weevil; and whole fields that produced straw enough for 25 to 30 bushels to the acre were not cut at all. Ohio Agr'l. Report 1855, p. 137.

Defiance County.—The weevil or midge has not damaged the crops as last year. Loc. cit., p. 142.

Jefferson County.—Wheat crop is good this year, but some wheat injured by the red weevil; late wheat suffered most. Loc. cit., p. 164.

Knox County.—But little wheat sown, owing to failure of previous years, and that affected to some extent by the fly and weevil. Loc. cit., p. 166.

Muskingum County.—Wheat less injured in this county than for several years past. Loc. cit., p. 191.

Ottawa County.—Wheat seriously injured by weevil and wet weather. Loc. cit., p. 193.

Richland County.—But little wheat sown, owing to destruction of previous crop and consequent lack of seed. Loc. cit., p. 201.

Tuscarawas County.—Early in summer the prospects of a good wheat crop were unpromising from the seeming depredations of the yellow weevil. Fortunately, however, the ravages of this dreaded insect were not so formidable as was apprehended. Loc. cit., p. 212.

Wood County.—But little wheat raised in this county during the past two years, the weevil having destroyed nearly the entire crop. Its ravages this year were far less than they were last, some fields having entirely escaped. Loc. cit., p. 224.

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* It is a matter of regret that the reports of this year's depredations should have been so few, even though, as one correspondent stated, "as there was no wheat, therefore there was nothing to report." As the matter stands, the deficiency of 8,000,000 bushels in the wheat crop of the state, for the year 1854, is to be attributed to wheat midge and drouth, with, for all that these reports indicate, no way of determining the extent to which each of the two factors is to be accredited with causing the damage.

1856.

Ashland County.—But very little wheat was damaged by this insect (weevil). Ohio Agr'l Report 1856, p. 190.

Belmont County.—The later ripening fields of wheat were more or less injured in proportion to the time of ripening, the latest being entirely destroyed by the midge. Loc. cit., p. 205.

Columbiana County.—For several years our crop has suffered from the ravages of the weevil. This year an unseasonable frost and weevil combined have reduced the crop to perhaps not over 10 or 12 bushels per acre. Loc. cit., p. 221.

Hancock County.—Wheat was not injured by weevil. Loc. cit., p. 256.

Harrison County.—For three years back the wheat crop has been almost a failure, destroyed by red weevil. Loc. cit., p. 259.

Huron County.—Previous to the approach of the red weevil this was considered a good wheat growing district; in consequence of the destruction produced by this enemy wheat growing was for a time abandoned, but the efforts of 1855 were attended with such success as to induce a greater effort in 1856. Loc. cit., p. 264.

Jefferson County.—But to crown the whole and finish out the wheat crop of Jefferson County, the weevil, that greatest pest of the farmer, set in and destroyed some fields of wheat totally—I, for one, left 13 acres uncut. Loc. cit., p. 270.

Lucking County.—The quality of the wheat was very good, except in some localities where it was affected by the weevil. Loc. cit., p. 279.

Lorain County.—But little wheat sown and this injured by the weevil somewhat. Loc. cit., p. 284.

Morgan County.—Owing to the ravages of the weevil and the drouth our crop has not been so good during the past year as for some years previous. Loc. cit., p. 296.

Tuscarawas County.—The wheat crop was almost a total failure by reason of the depredations of the yellow weevil. Loc. cit., p. 328.

Wayne County.—The crops in this county were not more than half the usual average on account of the weevil. Loc. cit., p. 335.

Williams County.—Wheat not so much affected by the midge this year as last. Loc. cit., p. 339.

1857.

Harrison County.—The weevil took possession in many places in the late sown and nearly destroyed it. Ohio Agr'l Report 1857, p. 262.

Lorain County.—Wheat good, very little injured by weevil or rust. Loc. cit., p. 272.

Williams County.—Wheat somewhat injured by weevil. Loc. cit, p. 294.

1858.

Coshocton County.—Wheat crop continues to be a failure, owing to the midge and rust. Ohio Agr'l Report 1858, p. 197.

1859.

Belmont County.—Did but little damage. Ohio Agr'l Report 1859, p. 132.

Franklin County.—Attack of no consequence. Loc. cit., p. 160.

Fulton County.—The midge did not so much injury as formerly. Loc. cit., p. 166.

Monroe County.—The real weevil or midge attacked the wheat in this county about three years ago and has not yet disappeared. Loc. cit., p. 200.

1861.

Crawford County.—The weevil and Hessian fly injured the wheat to a slight extent. Ohio Agr'l Report 1861, p. 103.

Fayette County.—The weevil has done some harm to the wheat. Loc. cit., p. 107.

Greene County.—There were many fields injured by the weevil. Loc. cit., p. 112.

Guernsey County.—Wheat 10, corn 20 bushels; the weevil damaged the former. Loc. cit., p. 113.

Hocking County.—Wheat crop considerably below the average, having been considerably injured by the weevil. Loc. cit., p. 118.

Highland County.—Wheat crop suffered materially from ravages of the weevil in a large portion of the county, thus reducing the crop about one-half the usual average, and of inferior quality. Loc. cit., p. 116.

Huron County.—Wheat slightly injured by weevil. Loc. cit., p. 118.

Jackson County.—Up to the last days of June wheat gave promise of 15 bushels per acre, but was so damaged by midge before harvest that the yield did not exceed 8 bushels per acre. Loc. cit., p. 118.

Knox County.—Midge and Hessian fly injured our wheat crop to some extent. March and April wet. Only one rain from June 5th to late in September. Loc. cit., p. 119.

Marion County.—The midge or weevil injured the wheat crop to some extent. Loc. cit., p. 129.

Morgan County.—The weevil is about the only insect that injured the crops, and that is decreasing. Loc. cit., p. 134.

Portage County.—The weevil almost entirely destroyed late wheat, while early wheat was about an average crop. Loc. cit., p. 140.

Summit County.—The weevil caused some damage to wheat, nearly destroying some fields. Loc. cit., p. 146.

1862.

Highland County.—The midge injured the wheat in some few localities, and in others it was not observed. Ohio Agr'l. Report 1862, p. 154.

Lorain County.—Spring wheat was nearly a failure, being mostly destroyed by the midge. Loc. cit., p. 159.

Muskingum County.—Either from the introduction of the Lambert or weevil-proof wheat, as it is termed, or from the disappearance or other cause, the ravages of that pest have been less than in the year preceding. Loc. cit., p. 166.

1863.

Clinton County.—Injured to some extent by the weevil and the fly. Ohio Agr'l. Report 1863, p. 136.

Lucas County.—Much injury resulted to wheat from the attacks of the Russian (Hessian?) fly and weevil. Loc. cit., p. 146.

Medina County.—The insects that injure crops are the worm in apples, grasshoppers and weevil. Loc. cit., p. 147.

Stark County.—The weevil, having for the past few years played sad havoc with this grain (wheat) have now nearly disappeared. Loc. cit., p. 156.

1864.

Jackson County.—The midge injured the wheat in some localities. Ohio Agr'l. Report 1864, p. 170.

Licking County.—Weevil was very bad in some fields of wheat. Loc. cit., p. 170.

1865.

Ashland County.—The defect in wheat crop was caused by weevil and rust. Ohio Agr'l. Report 1865, p. 206.

Auglaize County.—Our wheat crops were severely injured by the weevil the past season and yielded on an average about 8 bushels per acre. Loc. cit., p. 209.

Harrison County.—Wheat the last year was almost a failure in consequence of the weevil or midge. There is not more than one-half enough raised to supply the county. Some years ago, when the weevil made its appearance first into our county, it was thought by farmers generally, that early varieties of wheat were less liable to the ravages of the weevil. Thereupon the Mediterranean was selected by the farmers, generally, as the kind that would succeed, as it ripened several days earlier than the finer varieties of wheat. In a few years the weevil almost entirely disappeared. The people then began to abandon the Mediterranean, and in its stead, sow some of the white varieties of smooth wheat, which was the case last year. And notwithstanding the wheat last year ripened ten days earlier than usual, yet it was almost destroyed by weevil—demonstrating to us conclusively, that it don't depend upon the time of ripening as to whether the weevil will destroy it, but it probably depends more upon the variety sown. Loc. cit., p. 224.

Mahoning County.—The fall crops were poor, owing to late frosts and effect of weevil. Loc. cit., p. 231.

Shelby County.—Wheat badly injured by rust and weevil. Loc. cit., p. 238.

Van Wert County.—Wheat badly winter killed in the first place, and what remained was destroyed by weevil and rust. Loc. cit., p. 240.

Wayne County.—Wheat not a medium crop; injured by rust and weevil. Loc. cit., p. 241.

Wood County.—Wheat was a short crop and quite inferior in quality, owing to the ravages of the weevil. Loc. cit , p. 243

1866.

Henry County.—The wheat crop this season was almost a perfect failure, being badly winter killed and destroyed by the weevil. Ohio Agr'l. Report 1866, p. 155.

Laurence County.—Wheat badly winter killed and somewhat injured by the midge, and the crop consequently light. The midge has injured the wheat crop to a considerable extent the past three or four years, but has done probably much less damage this year than last. The later varieties of white wheat have suffered most from this insect, while the earlier varieties have not been much injured. Loc. cit., p. 159.

Williams County.—Wheat very light; not one-fourth of an average; cause, frozen out in winter and ravages of weevil. Loc. cit., p. 183.

1867.

Miami County.—Wheat midge did considerable damage in most parts of the county. Ohio Agr'l. Report 1867, p. 194.

Williams County.—Wheat nearly a total failure in consequence of hard freezing and the ravages of the weevil. Loc. cit., p. 209.

1868.

Erie County.—Wheat injured considerably by hot weather, red rust, and some by wheat midge. Ohio Agr'l. Report 1868, p. 197.

1869.

Erie County.—The wheat midge has not this season done much damage in this section; seems to be gradually disappearing. Ohio Agr'l. Report 1869, p. 251.

1872.

Clermont County.—Destructive insects in grain—midge, web-worm, heart-worm and white grub. Ohio Agr'l. Report 1872, p. 174.

1877.

Preble County.—Some few fields had fly in it, but there was scarcely any weevil in this county. Ohio Agr'l. Report 1877, p. 204.

1878.

Butler County—The midge in some parts of the county did some injury to the wheat, but only to a limited extent. Ohio Agr'l. Report 1878, p. 192.

Seneca County—The Hessian fly and midge are about the only insects that are destructive to wheat. The damage in the county has not been much. Loc. cit, p. 229.

The present season (1891) the wheat midge appeared in the wheat fields of the Experiment Station in considerable numbers, but, as I did not become connected with the Station until wheat was nearly all harvested, and, besides, being entirely unfamiliar with the locality and fields, it seems best to leave to the Agriculturist the duty of recording such information as was obtained with respect to extent of injury, varieties most affected and localities sustaining severest attack. From glancing over the preceding record of the occurrences of the pest during past years, it will be clearly observed that local outbreaks like this, lasting but a single year, are of common occurrence, and it is not possible to say now, to what extent the insect will appear next year, or even if it will appear at all. Therefore, while late varieties and late sown grain would probably be most affected, in case of a reappearance, the early sown grain will court the attack of Hessian fly. Hence, the prospect of the reappearance of the midge next year, does not seem to me sufficient to warrant advising generally early sowing this fall, as a means of protecting the crop next season.

In addition to what has been given with regard to the development of the adult, it may be stated that from chaff taken from the thresher on July 30, adults have emerged almost continually up to date, August 12. The first adults to emerge were, to all appearances, females of the form described by Dr. Fitch as *cerealis*, while later those emerging were typical *tritici*. This raises the question of food habits of the larvæ during autumn, and leads us to wonder if they might not feed upon the red rust spores, so common in early sown wheat during the fall months.

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